UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to:
2003/00695

June 7, 2004

Mr. Robert E. Willis
Chief, Environmental Resources Branch
Portland District, U.S. Army Corps of Engineers
Attn: CENWP-PM-E (Mr. Steve Helm)
P.O. Box 2946
Portland, Oregon 97208-2946

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery and Conservation Management Act Essential Fish Habitat Consultation, 2004 Cook Slough Tide Gate Replacement Project, Lower Youngs River (#170800060108), Clatsop County, Oregon

Dear Mr. Willis:

Enclosed is a biological opinion (Opinion) prepared by NOAA's National Marine Fisheries Service (NOAA Fisheries) pursuant to section 7 of the Endangered Species Act (ESA) on the effects of carrying out the proposed tide gate replacement on Cook Slough, in Clatsop County, Oregon. In this Opinion, NOAA Fisheries concludes that the proposed action is not likely to jeopardize the continued existence of twelve ESA-listed salmonids, or destroy or adversely modify designated critical habitat. As required by section 7 of the ESA, NOAA Fisheries has included reasonable and prudent measures with nondiscretionary terms and conditions that are necessary to minimize the impact of incidental take associated with this action.

This document also serves as consultation on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and includes conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects to EFH. NOAA Fisheries concludes that the proposed action will adversely affect EFH for groundfish and coastal pelagic fish species (listed in Table 2 of the Opinion) and EFH for Chinook and coho salmon. Section 305(b)(4)(B) of the MSA requires Federal agencies to provide a detailed written response to NOAA Fisheries within 30 days after receiving these recommendations. If the response is inconsistent with the recommendations, the action agency must explain why the recommendations will not be followed, including the justification for any disagreements over the effects of the action and the recommendations.

Please direct any questions regarding this consultation to Robert Markle, fisheries biologist, in the Oregon Coast/Lower Columbia River Habitat Branch of the Oregon State Habitat Office at 503.230.5419.

Sincerely,

for Michael R Crouse

D. Robert Lohn
Regional Administrator

Endangered Species Act - Section 7 Consultation
Biological Opinion

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Magnuson-Stevens Fishery Conservation and Management Act
Essential Fish Habitat Consultation

2004 Cook Slough Tide Gate Replacement Project
Lower Youngs River (#170800060108), Clatsop County, Oregon

Agency:	U.S. Army Corps of Engineers, Portland District
Consultation Conducted By:	NOAA's National Marine Fisheries Service, Northwest Region
Date Issued:	June 7, 2004
Issued by:	For Michael R Crouse D. Robert Lohn Regional Administrator
Refer to:	**2003/00695**

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1. INTRODUCTION

The Endangered Species Act (ESA) of 1973 (16 USC 1531-1544), as amended, establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with U.S. Fish and Wildlife Service and NOAA's National Marine Fisheries Service (NOAA Fisheries), as appropriate, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitats. This biological opinion (Opinion) is the product of an interagency consultation pursuant to section 7(a)(2) of the ESA and implementing regulations found at 50 CFR 402.

The analysis also fulfills the essential fish habitat (EFH) requirements under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a Federal fisheries management plan. Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2)).

1.1 Background and Consultation History

On June 4, 2003, NOAA Fisheries received a letter from the U.S. Army Corps of Engineers (Corps) requesting informal consultation pursuant to section 7(a)(2) of the ESA, and EFH consultation pursuant to section 305(b)(2) of the MSA for the replacement of a tide gate and bank stabilization in Cook Slough, Clatsop County, Oregon. On June 25, 2003, NOAA Fisheries requested additional information. On November 14, 2003, representatives from NOAA Fisheries, the Corps, Clatsop County Drainage District Number 9, and the Oregon Department of Fish and Wildlife (ODFW) met onsite to review the proposed action. On March 9, 2004, NOAA Fisheries received a letter from the Corps revising the proposed action and providing additional information regarding the proposed tide gate. The same letter requested informal consultation pursuant to section 7(a)(2) of the ESA.

The Corps determined the proposed action was not likely to adversely affect the following ESA-listed species: Snake River (SR) steelhead (*Oncorhynchus mykiss*), Upper Columbia River (UCR) steelhead, Middle Columbia River (MCR) steelhead, Upper Willamette River (UWR) steelhead, Lower Columbia River (LCR) steelhead, SR spring/summer-run Chinook salmon (*O. tshawytscha*), SR fall-run Chinook salmon, UCR spring-run Chinook salmon, UWR Chinook salmon, LCR Chinook salmon, Columbia River (CR) chum salmon (*O. keta*), and SR sockeye salmon (*O. nerka*). The Corps based this determination on NOAA Fisheries' previous concurrence with a similar action proposed in 2001. The Corps similarly determined the proposed action would not adversely affect designated EFH under the MSA. After reviewing the information provided by the Corps, including the biological assessment (BA) submitted June 2, 2003, NOAA Fisheries finds it cannot concur with the Corps' determination. This decision is based on the following reasons. Since 2001, NOAA Fisheries' understanding of the effects of tide gates on aquatic resources has grown (Giannico and Souder 2004). In addition, the currently proposed action differs from the action consulted on in 2001 because: (1) The proposed action will occur during spring when the juvenile salmonid presence is reasonably certain to occur; and (2) the proposed tide gate will not provide for fish passage. Therefore, NOAA Fisheries elects to complete ESA consultation by issuing this Opinion, and notified the Corps of this decision on April 19, 2004.

Furthermore, the Corps did not provide an assessment of effects on coho salmon, groundfish, or coast pelagic EFH designated under the MSA. In the absence of that information and in consideration of the points described above regarding salmonids, NOAA Fisheries has completed EFH consultation and accordingly herein provided conservation recommendations.

1.2 Proposed Action

The proposed project site is within Clatsop County Drainage District Number 9 near Miles Crossing, and is beside Wireless Road, approximately 0.33 mile east of Highway 101 Business (~ 46° 9" 43" N, 123° 49" 48" W). Presently, a pair of tide gates in the levee allows Cook Slough waters to enter the lower Youngs River near Daggett Point via a drainage ditch that passes beneath Wireless Road (Figures 1 and 2). This area is considered part of the greater Columbia River estuary.

On October 28, 2000, a storm event in conjunction with a high-tide event undermined the 3-foot by 8-foot wood tide box assembly, then positioned beneath Wireless Road, and breached a 100-foot section of the road and associated levee. Temporary measures were taken to repair the road and levee, including the installation of a 72-inch diameter temporary pipe with a cast iron tide gate approximately 200 feet north of the road failure (Figure 2). For the period of 1937 to 1989, this site was the location of an earlier 3-foot by 10-foot tide box. In June 2002, the Corps installed a 60-inch diameter pipe with a delayed-closing aluminum tide gate beside the temporary iron tide gate. Problems encountered during installation prevented the 60-inch pipe and tide gate invert from being placed at the appropriate elevation (-1 mean lower-low water). The proposed action is needed to provide sufficient flood control discharge.

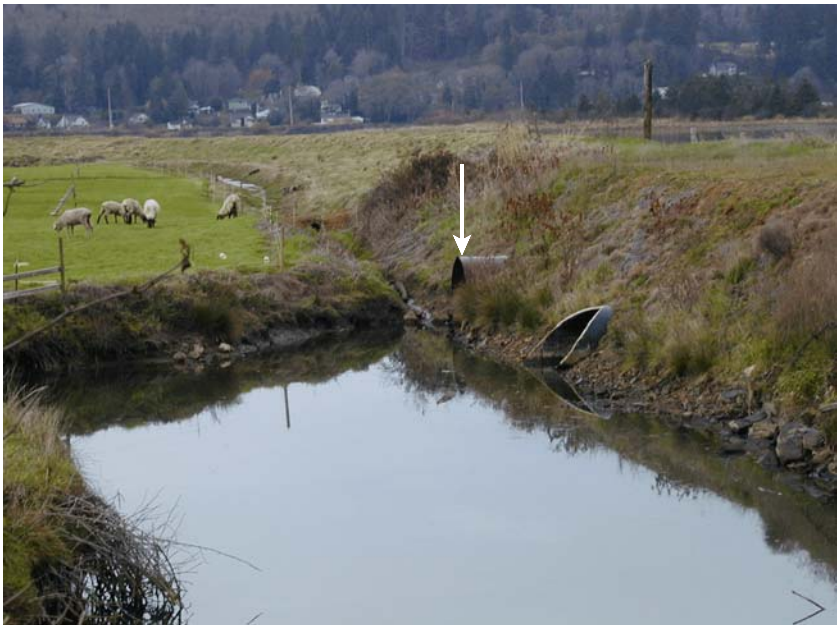
Figure 1. The Cook Slough tide gates discharge to lower Youngs River (a) via a drainage ditch that crosses beneath Wireless Road (b). White arrows indicate location of proposed action. Black arrow indicates county-owned culvert at Wireless Road culvert. [Images courtesy of the USGS.]

(a)

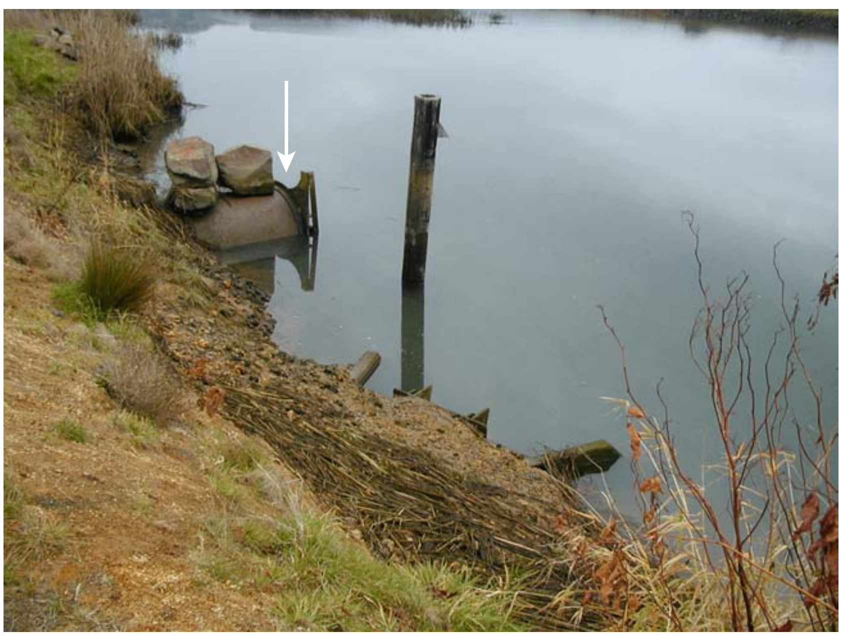
(b)

Figure 2. Existing tide gates on Cook Slough approximately 200 feet North of Wireless Road: (a) inflow and (b) outflow. Arrows indicate the temporary pipe and tide gate proposed for replacement.

(a)



(b)



The action proposed, and the subject of this consultation, involves the replacement of the temporary 72-inch diameter pipe and iron tide gate assembly (Figure 2). The new aluminum tide gate will be top-hinged and will not include the delayed closing feature of the adjacent tide gate. The delayed closing feature purportedly increases water exchange, which benefits slough water quality and provides low-velocity fish passage twice daily during the diurnal tidal cycle. The sufficiency of the existing delayed closing gate for providing fish passage has not been evaluated, but it does not meet NOAA Fisheries' draft passage criteria for tide gates (February 2004 draft).[1] The pipe invert will be installed at -1.0 feet mean lower-low water (MLLW) elevation. The Corps proposes to complete the new tide gate installation in early June 2004, when the predicted lower-low tide will be below the MLLW elevation. Culvert removal and installation during lower-low tides in early June will minimize or avoid working when the site is inundated. No rip-rap is proposed as part of this action.

The letter received from the Corps on March 9, 2004, indicated that project will be conducted in the same manner as the action consulted on in 2001, including the environmental precautions used. These precautions include:

1. Tide-gate assembly installation will occur in the dry during low tide.
2. Concrete will be prevented from contacting fish-bearing waters.
3. Temporary erosion control measures will be implemented.

1.3 Description of the Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area (project area) involved in the proposed action (50 CFR 402.02). For this consultation, NOAA Fisheries defines the action area as all aquatic habitat in Cook Slough solely accessible to fish via passage through the Cook Slough tide gates and that area of the lower Youngs River within 300 feet of the culvert replacement. While technically included in the Youngs River watershed by delineation, this reach of the lower Youngs River is functionally part of Youngs Bay and is considered part of the greater Columbia River estuary.

2. ENDANGERED SPECIES ACT

2.1 Biological Opinion

NOAA Fisheries listed the 12 species of salmon and steelhead considered in this Opinion under the ESA, and issued protective regulations under section 4(d) of the ESA (Table 1). Critical habitat is currently designated for three of these species: SR fall Chinook salmon, SR spring/summer Chinook salmon, and SR sockeye salmon.

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[1] Available at URL: http://www.nwr.noaa.gov/1hydrop/hydroweb/docs/Passagecriteria.extrevdraft.pdf.

Table 1. Endangered and threatened pacific salmon and steelhead under NOAA Fisheries' jurisdiction in Oregon

Evolutionarily Significant Unit	Final Rule E = Endangered T = Threatened	Critical habitat (Final Rule)	Protective Regulations (Final Rule)
Snake River fall Chinook salmon	T: April 22, 1992; 57 FR 14653	December 28, 1993; 58 FR 68543	April 22, 1992; 57 FR 14653
Snake River spring/summer Chinook salmon	T: April 22, 1992; 57 FR 146531	October 25, 1999; 64 FR 57399	April 22, 1992; 57 FR 14653
Snake River sockeye salmon	E: November 20, 1991; 56 FR 58619	December 28, 1993; 58 FR 68543	ESA section 9 applies
Snake River steelhead	T: August 18, 1997; 62 FR 43937	N/A	July 10, 2000; 65 FR 42422
Lower Columbia River Chinook salmon	T: March 24, 1999; 64 FR 14308	N/A	July 10, 2000; 65 FR 42422
Upper Columbia River spring Chinook salmon	E: March 24, 1999; 64 FR 14308	N/A	ESA section 9 applies
Upper Willamette River Chinook salmon	T: March 24, 1999; 64 FR 14308	N/A	July 10, 2000; 65 FR 42422
Columbia River chum salmon	T: March 25, 1999; 64 FR 14508	N/A	July 10, 2000; 65 FR 42422
Middle Columbia River steelhead	T: March 25, 1999; 64 FR 14517	N/A	July 10, 2000; 65 FR 42422
Lower Columbia River steelhead	T: March 19, 1998; 63 FR 13347	N/A	July 10, 2000; 65 FR 42422
Upper Willamette River steelhead	T: March 25, 1999; 64 FR 14517	N/A	July 10, 2000; 65 FR 42422
Upper Columbia River steelhead	E: August 18, 1997; 62 FR 43937	N/A	ESA section 9 applies

The objective of this Opinion is to determine whether the 2004 Cook Slough Tide Gate Replacement Project proposed by the Corps is likely to jeopardize the continued existence of ESA-listed species or destroy or adversely modify designated critical habitat for Snake River salmon species.

2.1.1. Biological Information and Critical Habitat

Biological Information
Based on migratory timing, listed salmon and steelhead species are reasonably certain to be present in the action area during the proposed construction period (early June). The action area serves as rearing habitat and as saltwater acclimation habitat for juvenile salmon and steelhead. Steelhead migrate year-round, with peak smolt out-migration occurring May through June, and peak adult migration occurring January through June. Sockeye salmon migrate April through August, with peak smolt out-migration occurring May through June, and peak adult migration occurring June through July. Chinook salmon migrate year-round, with peak smolt out-migration occurring March through July, and peak adult migration occurring March through October. Subyearling juvenile Chinook may rear for one week to five months in estuaries. Chum salmon migrate October through May, with peak smolt out-migration occurring March through May, and peak adult migration occurring October through November. Chum salmon have been extirpated from the Youngs River watershed. Additional biological information on the subject species is included in Appendix A of this document.

Critical Habitat
NOAA Fisheries designates critical habitat based on physical and biological features that are essential to the listed species. For this Opinion, NOAA Fisheries has designated critical habitat for SR sockeye salmon, SR fall Chinook salmon, and SR spring/summer Chinook salmon. Designated critical habitat for these species includes all Columbia River estuarine areas. The essential features of designated critical habitat within the action area that support successful spawning, incubation, fry emergence, migration, holding, rearing, and smoltification for ESA-listed salmonid fishes include: (1) Substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food (primarily juvenile), (8) riparian vegetation, (9) space, and (10) safe passage conditions.

2.1.2 Evaluating Proposed Actions

The standards for determining jeopardy are set forth in section 7(a)(2) of the ESA as defined by 50 CFR 402 (the consultation regulations). NOAA Fisheries must determine whether the action is likely to jeopardize the listed species and/or whether the action is likely to destroy or adversely modify critical habitat. This analysis involves the initial steps of: (1) Defining the biological requirements of the listed species; and (2) evaluating the relevance of the environmental baseline to the species' current status.

Subsequently, NOAA Fisheries evaluates whether the action is likely to jeopardize the listed species by determining if the species can be expected to survive with an adequate potential for recovery. In making this determination, NOAA Fisheries must consider the estimated level of adverse effect attributable to: (1) The environmental baseline; (2) collective effects of the proposed or continuing action; and (3) any cumulative effects. This evaluation must take into account measures for survival and recovery specific to the listed species' life stages that occur beyond the action area. If NOAA Fisheries finds that the action is likely to jeopardize the listed species or likely to destroy or adversely modify designated critical habitat, it must identify reasonable and prudent alternatives for the action.

For the proposed action, NOAA Fisheries' jeopardy analysis considers direct or indirect effects attributable to the proposed action.

2.1.3 Biological Requirements

The first step in the methods NOAA Fisheries uses for applying the ESA section 7(a)(2) to listed salmon is to define the species' biological requirements that are most relevant to each consultation. NOAA Fisheries finds that these biological requirements may be expressed in terms of environmental factors that define properly functioning aquatic habitat necessary for the survival and recovery of salmon. Environmental factors include water quality, habitat access, physical habitat elements, river channel condition, hydrology, and watershed condition. Properly functioning watersheds where healthy aquatic ecosystems exist are necessary for the survival and recovery of the species. Actions that have the potential to hinder the attainment of healthy aquatic ecosystems may prevent the species' survival and recovery in the natural environment.

When considering species survival and recovery, NOAA Fisheries also considers the current status of the listed species taking into account population size, trends, distribution, and genetic diversity. To assess the current status of the listed species, NOAA Fisheries starts with the determinations made in its decision to list the species for ESA protection and considers any new available data relevant to the species.

The relevant biological requirements are those necessary for the listed species to survive and recover to naturally-reproducing population levels, at which time protection under the ESA would become unnecessary. Adequate population levels must safeguard the genetic diversity of the listed stock, enhance their capacity to adapt to various environmental conditions, and allow them to become self-sustaining in the natural environment. Biological information and status of each of the twelve listed species is summarized in Appendix A. In spite of increased returns in recent years, the status of the subject species, based on their risk of extinction, has not significantly improved since the species were listed. This elevated extinction risk is largely reflective of the cyclic nature of oceanic conditions, freshwater habitat conditions that are degraded and not properly functioning, and hatchery practices that threaten the species' ability to survive the natural range of habitat variability.

For this consultation, the biological requirements are improved habitat characteristics that function to support successful adult migration, juvenile rearing and migration, and smoltification.

2.1.4 Environmental Baseline

In step two of the jeopardy analysis, we evaluate the relevance of the environmental baseline in the action area. The environmental baseline represents the habitat conditions to which the effects of the proposed or continuing action would be added. It includes past and present impacts of all Federal, state, or private activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have undergone section 7 consultation, and the impacts of State and private actions which are contemporaneous with the consultation in process (50 CFR § 402.02). The environmental baseline analysis includes a summary of the status of threatened and endangered species in the action area.

<u>Youngs River Watershed</u>
Over the past century, human activities have altered the range of physical forces in the Columbia River basin, including the Youngs Bay watersheds, including the Youngs River watershed. To a significant degree, the risk of extinction for salmon stocks in the Columbia River basin has increased because complex freshwater and estuarine habitats needed to maintain diverse wild populations and life histories have been lost and fragmented. Estuarine habitat has been lost or altered directly through diking, filling, and dredging, and also has been degraded through changes to flow regulation that affect sediment transport and salinity ranges of specific habitats within the estuary. Not only have salmonid rearing habitats been eliminated, but the connections among habitats needed to support tidal and seasonal movements of juvenile salmon have been severed.

The lower Columbia River estuary lost approximately 43% of its tidal marsh (from 16,180 acres historically to 9,200 acres today), and 77% of its historic tidal swamp habitats (from 32,020 acres historically to 6,950 acres today) between 1870 and 1970 (Thomas 1983). One example is the diking and filling of floodplains that were formerly connected to the tidal river. This practice eliminated large expanses of low-energy, off-channel habitat for salmon rearing and migrating during high flows. Similarly, diking of estuarine marshes and forested wetlands within the estuary removed most of these important off-channel habitats. Between 1917 and 1939, extensive areas of Youngs Bay were diked (Bischoff *et al*. 2000). Currently, "estuarine wetlands represent less than 0.2% of the watershed" (Bischoff *et al*. 2000).

<u>Action Area</u>
Historically, the action area was a complex of salt marsh wetlands and low marsh/swamp/forested wetlands. The area is thought to have been largely converted to agricultural use in the early-to-mid 1900s. Land use is managed primarily for agricultural and rural residential land uses. Conversion of Cook Slough resulted in a substantial loss of estuarine habitat that served an important freshwater/saltwater transition zone for salmonid fishes in the Columbia River basin. Youngs Bay and the lower Youngs River may contain predominately Columbia River water. A survey completed in June during high Columbia River runoff and relatively low tributary flow indicated Columbia River water upstream to river mile 6 of the Youngs River (Bischoff *et al*. 2000).

Physical barriers (*e.g.*, levees and tide gates) inhibit volitional use of Cook Slough by salmon and steelhead, prevent off-channel habitat use, and may entrap fish in poor habitat. While conditions may allow beneficial fish use of Cook Slough during most seasons, high water temperatures may preclude use during summer. Land use and water control (*e.g.*, grazing, tide gates) within the drainage area for Cook Slough likely means the chemical and nutrient criteria are not properly functioning. The lack of fencing to prevent livestock access to Cook Slough has degraded streambank condition. Restriction of tidal inundation by water control structures, soil compaction due to grazing, and tiling of pastures has altered the natural drainage network and flow characteristics within Cook Slough.

The existing baseline condition is not properly functioning for water temperature, chemical contamination/nutrients, physical barriers, off-channel habitat, streambank condition, peak and base flows, and drainage network. NOAA Fisheries concludes that not all of the biological requirements of the listed species within the action area are being met under current conditions. Based on the best available information on the subject species status, including population status, trends, and genetics, and the environmental baseline conditions within the action area, significant improvement in habitat conditions is needed to meet the biological requirements for the survival and recovery of the species.

2.1.5 Analysis of Effects

In step three of the jeopardy analysis, NOAA Fisheries examines the likely effects of the proposed action on the species and its habitat within the context of the species' current status and the existing environmental baseline. The analysis also takes into account the effects of actions that are interrelated or interdependent with the proposed action. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

NOAA Fisheries may use one, or both, of two independent techniques in assessing the effects of a proposed action. One technique considers effects in terms of how many listed salmon will be killed or injured during a particular life stage and gauge the effects of that take on population size and viability. Alternatively, the other technique uses a habitat approach, which considers the effects on the species' habitat requirements, such as water temperature, substrate composition, dissolved gas levels, structural elements, *etc*. The need to account for poorly understood exogenous effects necessitates that larger scale indicators of habitat condition be utilized in conjunction with these individual indicators of habitat condition. Where general relationships are understood (*e.g.*, degree of watershed disturbance and the condition of the aquatic environment), the use of watershed scale indicators are an important tool to evaluate the probability of effect.

The habitat approach analysis is especially useful for actions that alter the physical condition of the landscape because, while many cause and effect relationships between habitat quality and population viability are well known, they do not lend themselves to meaningful quantification in terms of fish numbers. Consequently, while the habitat effect analysis does not directly assess the effects of actions on population condition, the analysis indirectly considers this issue by evaluating existing habitat conditions in light of habitat conditions known to be conducive to salmon conservation. For the subject consultation, NOAA Fisheries will use the habitat effect analysis when evaluating potential effects to the subject species.

2.1.5.1 Effects of Proposed Actions

Fish may be killed, or more likely temporarily displaced, by in-channel work activities (Spence *et al.* 1996). Water control structures inherently affect physical and chemical conditions, and may affect biological conditions. The habitat functions affected by tide gates may include:

- Fish passage for adult and juvenile migrating salmonids.
- Estuarine water quality.
- Surface water hydrology and groundwater levels.
- Movement of woody debris.
- Natural flooding processes landward of the tide gate.
- Water temperature.
- Salinity gradient.
- Sediment transport regimes upstream and downstream of the tide gate.

<u>Construction Activities</u>
Construction activities that occur in stream channels (*e.g.*, excavation, culvert removal and installation, tide gate installation, placement of rock) are likely to temporarily increase concentrations of total suspended solids (TSS) and turbidity. Potential effects from project-related increases in turbidity on salmonid fishes include, but are not limited to: (1) Reduction in feeding rates and growth, (2) increased mortality, (3) physiological stress, (4) behavioral avoidance, (5) reduction in macroinvertebrate populations, and (6) temporary beneficial effects. Potential beneficial effects include a reduction in piscivorous fish/bird predation rates, enhanced cover conditions, and improved survival conditions.

Increases in TSS can adversely affect filter-feeding macroinvertebrates and fish feeding. At concentrations of 53 to 92 parts per million (ppm) (24 hours) macroinvertebrate populations were reduced (Gammon 1970). Concentrations of 250 ppm (1 hour) caused a 95% reduction in feeding rates in juvenile coho salmon (Noggle 1978). Concentrations of 1200 ppm (96 hours) killed juvenile coho salmon (Noggle 1978). Concentrations of 53.5 ppm (12 hours) caused physiological stress and changes in behavior in coho salmon (Berg 1983). Similar responses can be expected for the subject salmonid species.

The proposed in-channel work is likely to increase TSS and turbidity upstream during incoming tides and downstream of the work area during outgoing tides. Increases are attributable to ground disturbance activities below the mean higher-high water (MHHW) elevation. Furthermore, in the event the elevation of retained Cook Slough waters are greater than the design elevation for the pipe invert (-1.0 feet MLLW) at the time of assembly replacement, sluicing of the levee at the breach point may erode the levee until equilibrium is achieved or the connection ditch runs dry. The Corps has not proposed any work area isolation (*e.g.*, coffer dam) to reduce effects under that situation.

Increases in TSS and turbidity are likely to increase physiological stress, physical injury (*e.g.*, gill abrasion), and potentially displace rearing juvenile salmon and steelhead. The proposed action would occur outside of the work period recommended by the ODFW (November 1 to February 28). While the listed species may be present during the proposed action, construction during June allows better control of the work site and reduces the risk of storm or high flow damage that would likely increase the distribution and magnitude of any adverse effects to the species.

Furthermore, in spite of the previous discussion regarding potential sluicing, working during low-tide periods would reduce the amount of in-water work necessary to complete the project and minimize construction-related turbidity. The minimum elevation of the lower-low tides would range from -0.82 feet to -1.98 feet below the MLLW during the period of June 1 to June 7.[2] Lower-low tides would be below the indicated invert elevation during June 2 (Tuesday) through June 6 (Sunday) with minimum tides ranging from 7:34 AM (June 2) to 10:56 AM (June 6).

The Corps did not specifically indicate a concrete wingwall is proposed as part of the tide gate replacement, but did state that the action would be conducted in the same manner as the adjacent structure, which does have a concrete wingwall. Portland cement (consisting of concrete, mortar, and tile grout) can have adverse effects on fish by producing alkaline conditions in streams and rivers. When it dissolves in water it forms calcium hydroxide, $Ca(OH)_2$, a highly alkaline substance, and as a result produces a very high pH (~12 pH units at 25˚C) liquid (Fisheries and Oceans 2003). When the pH exceeds a neutral value of 7.0, fish may be adversely affected in the following ways: Death, damage to outer surfaces like gills, eyes, and skin, an inability to dispose of metabolic wastes and increased toxicity of other substances due to change in pH (Fisheries and Oceans 2004). The information provided by the Corps indicates that concrete will be prevented from contacting fish-bearing waters, but provided no explanation as to how this would be achieved. Therefore, NOAA Fisheries must assume some potential exists that contamination could occur.

The subject species are expected to exhibit avoidance behavior, though juveniles present in the action area may experience physical harm as a result of exposure to elevated TSS, turbidity, or exposure to abrupt changes in pH.

[2] Available at URL: http://tbone.biol.sc.edu/tide.

Tide Gate Operations and Hydraulics

The Corps provided no information on the operation of the proposed tide gate (*e.g.*, design tide inundation elevation, average daily period open, width of opening, closure elevation, water velocity).

As is currently the case, water temperature likely increases in Cook Slough during high tide when the tide gates are closed, which creates an unnaturally confined and relatively static body of water exposed to solar radiation in an open landscape. Preliminary results from temperature monitoring of sloughs with tide gates in Washington state indicate water temperatures could increase at any time of year, and could exceed lethal conditions (25°C / 77°F) at times (EPA 2003, NOAA Fisheries 2003). A point in time sampling of Cook Slough on September 26, 2001, by Astoria High School members indicated water temperatures during a flooding tide within the slough of 17°C (63°F) and on the bay side of the tide gate of 16°C (61°F).[3] The corresponding dissolved oxygen levels were 5 mg/L and 8 mg/L, respectively. This suggests, at least under certain circumstances, the estuarine waters within the lower Youngs River offer better habitat quality to salmonids than those within the slough.

The tide gate, with the delayed closing feature installed in 2002, likely provided marginally better tidal flushing, which likely improved water quality comparably. The proposed replacement of the iron tide gate with an aluminum gate is expected to result in the structure opening more readily, but the benefit to fish passage is likely insignificant. The aluminum gate may reduce entrapment, but also may reduce the volume of water retained during flood tides which under certain conditions could adversely affect fish in the slough (*e.g.*, exposure to elevated water temperature and/or low levels of dissolved oxygen).

The continued effects of degraded water quality are likely to primarily affect juvenile salmonid fishes, although effects to adult salmonids, such as depletion of energy reserves (Idler and Clemens 1959, Gilhousen 1980), pre-spawning mortality, and reduced viability of gametes (McCullough 1999) may occur if adults are trapped in the slough for extended periods of time.

The Wireless Road culvert (Figure 1), which provides the hydrologic connection between Cook Slough and the tide gates, is a 72-inch diameter pipe (28.3 feet^2 opening) owned by Clatsop County. This pipe may function as a hydraulic control point under certain conditions since the opening is significantly smaller than either the current (47.9 feet^2) or proposed (39.2 feet^2) tide gates. During periods of high water elevation disparity across the levee, this control point likely effects the performance of the tide gates downstream and may increase local erosion.

Although the proposed action is likely to marginally enhance water quality in Cook Slough when the tide gates are open, too many physical and chemical habitat factors remain uncertain to determine whether habitat conditions, during the time when the tide gates are closed, would meet the biological and behavioral requirements of listed salmon and steelhead. Therefore, in the

[3] Available at URL: http://www.lcrep.org/Oregon%20Tributary%20Data.pdf.

absence of definitive information, NOAA Fisheries draws the biologically conservative conclusion that the subject species would likely continue to be adversely affected by water quality when the tide gates are closed, with unpredictable effects on fish survival at the individual and population scales.

<u>Summary of Project Effects</u>
The 2004 Cook Slough Tide Gate Replacement Project is likely to result in short-term negative effects to water quality (*i.e.*, suspended sediments and pH) in sufficient magnitude to adversely affect ESA-listed species present in the action area. The likely adverse effects are attributed to sediment generated by the replacement of a temporary pipe and iron tide gate, and contamination from uncured concrete. The stream segments of habitat likely affected are: (1) An undetermined area on the bay side of the levee, however, tidal mixing is expected to limit the response area to less than 300 feet from the source (*i.e*., tide gate); and (2) an undetermined area on the slough side of the levee, however, the response area is expected to be limited to that area between the Wireless Road culvert and the tide gates.

The nature of the effect may include reduced respiratory efficiency due to gill irritation, reduced feeding efficiency due to poor visibility, avoidance of the affected area, reduced prey base, and reduced egg and fry development and survival. The activity (pipe and tide gate replacement) likely to generate the effects would occur only once with an effect response period not likely to exceed 2 days.

The proposed replacement of the tidegate is expected to have the short-term, localized effects on listed fish caused by waster quality effects noted above. The action does not clearly reduce the baseline effects of the existing tidgate (*e.g.*, on water temperature, DO, and fish passage conditions). As noted above, the latter effects are part of the baseline and thus not considered new effects of this action, and not interrelated/interdependent with this action, as they would continue to occur if the tidegate were not replaced. Any adverse effects associated with the ongoing operation of the tidegate are not included in this consultation, and not authorized under the incidental take statement (below).

2.1.5.2 Effects on Critical Habitat

NOAA Fisheries designates critical habitat based on physical and biological features that are essential to the listed species. Essential features of designated critical habitat include substrate, water quality, water quantity, water temperature, food, riparian vegetation, access, water velocity, space and safe passage. Effects on critical habitat from the proposed action are similar to the effects described above in section 2.1.5.1.

2.1.5.3 Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation."

NOAA Fisheries is not aware of any specific future non-federal activities within the action area that would cause greater effects to listed species than presently occurs. Between 1990 and 2000, the population of Clatsop County increased by 7.0%.[4] Thus, NOAA Fisheries assumes that future private and state actions will continue within the action area, increasing as population density rises. As the human population in the state continues to grow, demand for actions similar to the subject project likely will continue to increase as well. Each subsequent action may have only a small incremental effect, but taken together they may have a significant effect that would further degrade the watershed's environmental baseline and undermine the improvements in habitat conditions necessary for listed species to survive and recover.

2.1.6 Conclusion

NOAA Fisheries has determined that, based on the available scientific and commercial data, the 2004 Cook Slough Tide Gate Replacement Project is not likely to jeopardize the continued existence of the SR steelhead, UCR steelhead, MCR steelhead, UWR steelhead, LCR steelhead, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, UCR spring-run Chinook salmon, UWR Chinook salmon, LCR Chinook salmon, CR chum salmon, or SR sockeye salmon, and is not likely to destroy or adversely modify designated critical habitat for SR fall-run Chinook salmon, SR spring/summer-run Chinook salmon, and SR sockeye salmon. In arriving at this determination, NOAA Fisheries considered the aggregate effects of:

1. The factors of decline that have led to the species' current status;
2. the environmental baseline;
3. all the effects of the proposed action; and
4. the cumulative effects of other anticipated actions in the action area.

In summary, our conclusion is based on the following considerations: (1) The action replaces in-kind an existing structure and will not appreciably alter the degraded environmental conditions within the slough, (2) the action is limited in scope, (3) the action area is limited in scale, (4) the adverse effects due to culvert replacement are limited in duration, and (5) the take of ESA protected salmonids exposed to these adverse effects are limited to non-lethal harm.

2.1.7 Conservation Recommendations

Section 7(a)(1) of the ESA requires Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of threatened and endangered species. Conservation recommendations are discretionary measures suggested to avoid or minimize adverse effects of a proposed action on listed species, to avoid or minimize

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[4] U.S. Census Bureau, State and County Quickfacts: Clatsop County, Oregon. Available online at http://quickfacts.census.gov/qfd/states/41/41007.html

adverse modification of critical habitats, or to develop additional information. NOAA Fisheries believes the following recommendations are is consistent with these obligations, and therefore should be carried out by the Corps.

1. The Corps should consider whether work area isolation (*e.g.*, cofferdam) on the slough side of the levee would minimize turbidity during the Cook Slough tide gate replacement, and utilize such measures where appropriate.

2. The Corps should encourage Clatsop County to replace the Wireless Road culvert (72-inch pipe) to ensure this structure will not function as a hydraulic control point.

3. When planning for future installation or replacement of water control structures, the Corps should utilize the most recent version of NOAA Fisheries' Anadromous Salmonid Passage Facility Guidelines and Criteria.[5] This document provides criteria, rationale, guidelines and definitions for the purpose of designing proper fish passage facilities for the safe, timely and efficient upstream and downstream passage of anadromous salmonids at impediments created by man-made structures, natural barriers (where provision of fish passage is consistent with management objectives), or altered instream hydraulic conditions. The information needs for the completion of ESA consultation on such actions can be largely met by following the guidance provided in the document.

Please notify NOAA Fisheries if the Corps carries out these recommendations so that we will be kept informed of actions that minimize or avoid adverse effects, and those that benefit species or their habitats.

2.1.8 Reinitiation of Consultation

This concludes formal consultation on these actions in accordance with 50 CFR 402.14(b)(1). Reinitiation of consultation is required: (1) If the amount or extent of incidental take is exceeded; (2) the action is modified in a way that causes an effect on the listed species that was not previously considered in the BA and this Opinion; (3) new information or project monitoring reveals effects of the action that may affect the listed species in a way not previously considered; or (4) a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

2.2 Incidental Take Statement

The ESA at section 9 [16 USC 1538] prohibits take of endangered species. The prohibition of take is extended to threatened anadromous salmonids by section 4(d) rule [50 CFR 223.203]. Take is defined by the statute as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." [16 USC 1532(19)] Harm is defined by regulation as "an act which actually kills or injures fish or wildlife. Such an act may include

[5] Available at URL: http://www.nwr.noaa.gov/1hydrop/hydroweb/docs/Passagecriteria.extrevdraft.pdf.

significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavior patterns, including, breeding, spawning, rearing, migrating, feeding or sheltering." [50 CFR 222.102] Harass is defined as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering." [50 CFR 17.3] Incidental take is defined as "takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant." [50 CFR 402.02] The ESA at section 7(o)(2) removes the prohibition from any incidental taking that is in compliance with the terms and conditions specified in a section 7(b)(4) incidental take statement [16 USC 1536].

2.2.1 Amount or Extent of Take

NOAA Fisheries anticipates that the proposed action covered by this Opinion is reasonably certain to result in incidental take of listed species resulting from changes in water quality. Effects of actions such as these are largely unquantifiable in the short term, but are expected to be largely limited to non-lethal take in the form of behavior modification.

Therefore, even though NOAA Fisheries expects some low level of non-lethal incidental take to occur due to the construction action covered by this Opinion, the best scientific and commercial data available are not sufficient to enable NOAA Fisheries to estimate a specific amount of incidental take to the species themselves. In instances such as this, NOAA Fisheries designates the expected level of take in terms of the extent of take allowed. For this project, the extent of take will be limited to the aquatic area within a 300-foot radius of the structure. Take occurring beyond this area is not exempt from the take prohibition by this incidental take statement. Take associated with the ongoing operation of the subject tide gate (*e.g.*, exposure to poor water quality) is expressly not exempt from the take prohibition by this incidental take statement.

2.2.2 Reasonable and Prudent Measures

The measures described below are non-discretionary. They must be implemented so that they become binding conditions in order for the exemption in section 7(a)(2) to apply. The Corps has the continuing duty to regulate the activities covered in this incidental take statement. If the Corps fails to adhere to the terms and conditions of the incidental take statement, or fails to retain the oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

The following reasonable and prudent measures are necessary and appropriate to avoid or minimize the amount or extent of take of listed fish resulting from implementation of this Opinion. These reasonable and prudent measures would also avoid or minimize adverse effects to designated critical habitat.

The Corps shall:

1. Avoid or minimize incidental take from construction-related activities.

2. Ensure completion of a comprehensive monitoring and reporting program to confirm this Opinion is meeting its objective of minimizing take from authorized activities.

2.2.3 Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary and are applicable to more than one category of activity. Therefore, terms and conditions listed for one type of activity are also terms and conditions of any category in which they would also minimize take of listed species or their habitats.

1. To implement reasonable and prudent measure #1 (construction), the Corps shall:

    a. Work area. Confine construction impacts to the minimum area necessary to complete the project.
    b. In-channel work.
        i. Complete work below the MHHW elevation in the dry to the greatest extent possible (*i.e.*, during low tide).
        ii. Pipe removal and replacement will be completed during low tides of -1.0 feet or greater as predicted for Astoria (Youngs Bay), Columbia River, Oregon.
    c. Excavation. Use temporary erosion control measures to minimize sediment to the greatest extent possible.
    d. Contaminants.
        i. Inspect all vehicles operated within 150 feet of top-of-bank daily for fluid leaks before leaving the vehicle staging area. Repair any leaks detected in the vehicle staging area before the vehicle resumes operation.
        ii. No petroleum products shall be stored within 150 feet of any waterbody.
        iii. Refueling shall occur at least 150 feet from any waterbody.
        iv. Prevent concrete (uncured) contamination of fish-bearing waters, including any area used to washout mixing equipment.
    e. Water Pumping. Have a fish screen installed, operated and maintained in accordance to NOAA Fisheries' fish screen criteria (NOAA Fisheries 1995, 1996) (http://www.nwr.noaa.gov/1hydrop/hydroweb/ferc.htm) on any water intake structure used in waters potentially containing ESA-listed fish.
    f. Rock Use. Limit rock use to the minimum quantity necessary to protect the pipe and tide gate.

2. To implement reasonable and prudent measure #2 (monitoring), the Corps shall:

    a. Salvage notice. Include the following notice as a permit condition.

NOTICE. If a sick, injured or dead specimen of a threatened or endangered species is found, the finder must notify the Vancouver Field Office of NOAA Fisheries Law Enforcement at 360.418.4246. The finder must take care in handling of sick or injured specimens to ensure effective treatment, and in handling dead specimens to preserve biological material in the best possible condition for later analysis of cause of death. The finder also has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not disturbed unnecessarily.

b. Implementation monitoring. Ensure that within 60 days following completion of construction activities below MHHW, the Corps will submit a report to NOAA Fisheries with the following information:
   i. Confirmation that the proposed tide gate and culvert was built as proposed, including the implementation of conservation measures.
   ii. Specific methods used to minimize sediment mobilization and turbidity.
   iii. Extent, duration, and frequency of any turbidity plumes related to project activities.
   iv. Any observed injury and/or mortality of fish resulting from project implementation.
   v. Photographs of the action and tide gate operations as follows.
      (1) Conditions on site before and during the culvert removal and subsequent culvert reinstallation.
      (2) Showing operation of the new tide gate operation at four tidal points and conditions on both sides of the levee. The four tidal points are:
         (a) Low tide.
         (b) Rising tide.
         (c) High tide.
         (d) Falling tide.

c. Post-Construction Monitoring.
   i. Ensure a post-construction monitoring plan will be developed within 60 days following issuance of this Opinion. Monitoring plan objectives shall include, at a minimum:
      (1) Determine fish habitat quality (*e.g.*, water quality) and fish use in Cook Slough to better characterize the habitat suitability for salmon and steelhead.
      (2) Establish the design tide inundation elevation for this project, refer to section 9.5.3 of NOAA Fisheries' draft passage criteria [see footnote 1 of this document], and determine if tide gate operations adequately manage for that delineation.
      (3) Determine the degree of fish passage permitted via the operation of the Cook Slough tide gates as constructed.

ii. Post-construction monitoring shall be completed and a report submitted to NOAA Fisheries within 365 days following issuance of this Opinion.

d. Submit reports to:.

NOAA Fisheries
Habitat Conservation Division, Oregon State Habitat Office
Attn: 2003/00695
525 NE Oregon Street, Suite 500
Portland, OR 97232-2778

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

3.1 Background

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-297), requires the inclusion of EFH descriptions in Federal fishery management plans. In addition, the MSA requires Federal agencies to consult with NOAA Fisheries on activities that may adversely affect EFH. The objective of the EFH consultation is to determine whether the proposed action may adversely affect designated EFH for relevant species, and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH resulting from the proposed action.

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting the definition of essential fish habitat: Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and “spawning, breeding, feeding, or growth to maturity” covers a species' full life cycle (50 CFR 600.110).

Section 305(b) of the MSA (16 U.S.C. 1855(b)) requires that:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH;
- NOAA Fisheries shall provide conservation recommendations for any Federal or state activity that may adversely affect EFH;
- Federal agencies shall within 30 days after receiving conservation recommendations from NOAA Fisheries provide a detailed response in writing to NOAA Fisheries regarding the conservation recommendations. The response shall include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the conservation

recommendations of NOAA Fisheries, the Federal agency shall explain its reasons for not following the recommendations.

The MSA requires consultation for all actions that may adversely affect EFH, and does not distinguish between actions within EFH and actions outside EFH. Any reasonable attempt to encourage the conservation of EFH must take into account actions that occur outside EFH, such as upstream and upslope activities, that may have an adverse effect on EFH. Therefore, EFH consultation with NOAA Fisheries is required by Federal agencies undertaking, permitting or funding activities that may adversely affect EFH, regardless of their locations.

3.2 Identification of EFH

The Pacific Fisheries Management Council (PFMC) has designated EFH for federally-managed fisheries within the waters of Washington, Oregon, and California. The designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California, seaward to the boundary of the U.S. exclusive economic zone (200 miles) (PFMC 1998a, 1998b). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other waterbodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC), and longstanding, naturally-impassable barriers (*e.g.*, natural waterfalls in existence for several hundred years) (PFMC 1999). In estuarine and marine areas, designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone offshore of Washington, Oregon, and California north of Point Conception to the Canadian border.

Detailed descriptions and identifications of EFH for the groundfish species are found in the Final Environmental Assessment/Regulatory Impact Review for Amendment 11 to *The Pacific Coast Groundfish Management Plan* (PFMC 1998a) and the NOAA Fisheries *Essential Fish Habitat for West Coast Groundfish Appendix* (Casillas *et al.* 1998). Detailed descriptions and identifications of EFH for the coastal pelagic species are found in Amendment 8 to the *Coastal Pelagic Species Fishery Management Plan* (PFMC 1998b). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the *Pacific Coast Salmon Plan* (PFMC 1999). Assessment of the potential adverse effects to these species' EFH from the proposed action is based on this information.

3.3 Proposed Actions

The proposed action is detailed above in section 1.2 of this document. The action area includes all aquatic habitat in Cook Slough solely accessible to fish via passage through the Cook Slough tide gates and that area of the lower Youngs River within 300 feet of the culvert replacement. This area has been designated as EFH for various life stages of numerous groundfish, coastal pelagic fish, and salmon species (Table 2).

3.4 Effects of Proposed Action

As described in detail in section 2.1.5 of this document, the proposed action is likely to temporarily degrade water quality for ground fish species, Chinook and coho salmon, and coastal pelagic species due to temporarily increased turbidity, potential sediment and water column contamination.

3.5 Conclusion

The proposed action will adversely affect EFH for the groundfish, Pacific salmon species, and coastal pelagic listed in Table 2.

3.6 EFH Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations for any Federal or state agency action that would adversely affect EFH. The conservation measures proposed for the project by the Corps, all conservation recommendations outlined above in section 2.1.7 and all of the terms and conditions contained in section 2.2.3, except monitoring, are applicable to EFH. Therefore, NOAA Fisheries incorporates each of those measures here as EFH conservation recommendations.

3.7 Statutory Response Requirement

Please note that the MSA (section 305(b)) and 50 CFR 600.920(j) requires the Federal agency to provide a written response to NOAA Fisheries after receiving EFH conservation recommendations within 30 days of its receipt of this letter. This response must include a description of measures proposed by the agency to avoid, minimize, mitigate or offset the adverse impacts of the activity on EFH. If the response is inconsistent with a conservation recommendation from NOAA Fisheries, the agency must explain its reasons for not following the recommendation.

3.8 Supplemental Consultation

The Corps must reinitiate EFH consultation with NOAA Fisheries if either action is substantially revised or new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920).

Table 2. Species with designated EFH in the estuarine EFH composite in the state of Oregon

Groundfish Species	
Leopard Shark (southern OR only)	*Triakis semifasciata*
Soupfin Shark	*Galeorhinus zyopterus*
Spiny Dogfish	*Squalus acanthias*

California Skate	*Raja inornata*
Spotted Ratfish	*Hydrolagus colliei*
Lingcod	*Ophiodon elongatus*
Cabezon	*Scorpaenichthys marmoratus*
Kelp Greenling	*Hexagrammos decagrammus*
Pacific Cod	*Gadus macrocephalus*
Pacific Whiting (Hake)	*Merluccius productus*
Black Rockfish	*Sebastes maliger*
Bocaccio	*Sebastes paucispinis*
Brown Rockfish	*Sebastes auriculatus*
Copper Rockfish	*Sebastes caurinus*
Quillback Rockfish	*Sebastes maliger*
English Sole	*Pleuronectes vetulus*
Pacific Sanddab	*Citharichthys sordidus*
Rex Sole	*Glyptocephalus zachirus*
Rock Sole	*Lepidopsetta bilineata*
Starry Flounder	*Platichthys stellatus*
Coastal Pelagic Species	
Pacific Sardine	*Sardinops sagax*
Pacific (Chub) Mackerel	*Scomber japonicus*
Northern Anchovy	*Engraulis mordax*
Jack Mackerel	*Trachurus symmetricus*
California Market Squid	*Loligo opalescens*
Pacific Salmon Species	
Chinook Salmon	*Oncorhyncus tshawytcha*
Coho Salmon	*Oncorhyncus kisutch*

4. LITERATURE CITED

Biological opinions are required to be based on the best scientific and commercial data available. This section identifies the data used in developing this Opinion.

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APPENDIX A

ESA-Listed Columbia River Basin Salmon and Steelhead

ESA-Listed Columbia River Basin Salmon and Steelhead

Snake River (SR) Fall Chinook Salmon

The SR fall Chinook salmon evolutionarily significant unit (ESU) once spawned in the mainstem of the Snake River from its confluence with the Columbia River upstream to Shoshone Falls (RM 615). The spawning grounds between Huntington (RM 328) and Auger Falls (RM 607) were historically the most important for this species. Only limited spawning activity occurred downstream of RM 273 (Waples *et al.* 1991a), about one mile below Oxbow Dam (Waples *et al.* 1991a). However, irrigation and hydropower projects on the mainstem Snake River have inundated, or blocked access to, most of this area in the past century. The construction of Swan Falls Dam (RM 458) in 1901, eliminated access to much of this habitat and the completion of Brownlee Dam in 1958 (RM 285), Oxbow Dam in 1961 (RM 272), and Hells Canyon Dam in 1967 (RM 247) blocked access to the rest.

Since 1991, spawning has been limited primarily to the mainstem Snake River between a point upstream of Lower Granite Reservoir (RM 149) and Hells Canyon Dam (RM 247, and the lower reaches of the Grande Ronde, Clearwater, and Tucannon rivers, tributaries to the Snake River. Redds in the Clearwater River have been observed from its mouth to slightly upstream of its confluence with the north fork (about 40 miles).

No reliable estimates of historical abundance are available (Waples *et al.* 1991b), but because of their dependence on mainstem habitat for spawning, fall Chinook have probably been affected to a greater extent by irrigation and hydroelectric projects than any other species of salmon in the Snake River basin. The mean number of adult SR fall Chinook salmon declined from 72,000 in the 1930s and 1940s, to 29,000 during the 1950s. In spite of this, the Snake River remained the most important natural production area for fall Chinook in the Columbia River basin through the 1950s. The number of adults counted at the uppermost Snake River mainstem dams averaged 12,720 total spawners from 1964 to 1968; 3,416 spawners from 1969 to 1974; and 610 spawners from 1975 to 1980 (Waples, *et al.* 1991b). Most adult SR fall Chinook spend three years at sea before migrating up the Columbia and Snake Rivers between August and October (Waples *et al.* 1991b). Spawning occurs in the mainstem Snake River and in the lower parts of its major tributaries in between late October and mid-December, typically peaking in November (Myers *et al.* 1998). Fry emerge from the spawning beds from late March through early June. At present, the peak of the smolt outmigration usually occurs in July, however juvenile fall Chinook may be found migrating in the lower Snake and Columbia Rivers from May through October.[1] SR fall

[1] In its comments on the draft USBR 1999 Biological Opinion, the State of Idaho commented that "it is generally accepted that peak juvenile Snake River fall Chinook migration historically coincided with the declining hydrograph following spring snowmelt" (Kempthorne 1999). However, Krzma and Raleigh (1970) observed that the migration of juvenile fall Chinook into Brownlee Reservoir in 1962 and 1963 began in mid-April, and ended by mid-June (roughly 75% of the migration took place during the second and third weeks of May in those years). Juvenile fall Chinook captured between mid-May and mid-June averaged 71, 81, and 79 mm in 1962, 1963, and 1964, respectively. Similarly, Mains and Smith (1964), who monitored the migration of Chinook salmon in the lower Snake River (RM 82) in 1954 and 1955, collected Chinook salmon fry (most likely those of fall Chinook salmon) migrating in March and April, and documented that the migration of Chinook salmon smolts was nearly complete by the end of June. The average length of fingerlings in June was 90.7 mm. Thus, the historic migration of fall Chinook salmon through the Snake River was more likely to have occurred between late-May and late-June, nearer the peak of historical hydrograph.

Chinook typically exhibit an "ocean" type juvenile life history pattern, usually rearing in freshwater for only a few months before migrating to the ocean.

SR Spring/Summer Chinook Salmon

It is estimated that at least 1.5 million spring/summer Chinook salmon returned to the Snkae River in the late 1800s, approximately 39 to 44% of all spring/summer Chinook in the Columbia River basin. Historically, Shoshone Falls (RM 615) was the uppermost limit to spring/summer Chinook migration, and spawning occurred in virtually all suitable and accessible habitat in the Snake River basin (Fulton 1968, Matthews and Waples 1991). The development of mainstem irrigation and hydroelectric projects in the mainstem Snake River basin have so significantly reduced the amount of habitat available for spring/summer Chinook that between 1950 and 1960, an average of 125,000 adults returned to the Snake River; only 8% of the historic estimate. An estimated average of 100,000 wild adults would have returned from 1964 to 1968, each year after adjusting for fish harvested in the river fisheries below McNary Dam. However, actual counts of wild adults at Ice Harbor Dam annually averaged only 59,000 each year from 1962 to 1970. The estimated number of wild adult Chinook salmon passing Lower Granite Dam between 1980 and 1990, was 9,674 fish (Matthews and Waples 1991). A recent 5-year geometric mean (1992 to 1996) was only 3,820 naturally-produced spawners (Myers *et al.* 1998). This is less than 0.3% of the estimated historical abundance of wild SR spring/summer Chinook.

SR spring/summer Chinook migrate through the Columbia River from March through July, and spawn in smaller, higher elevation streams than do fall Chinook. Fry generally emerge from the gravel between February and June. SR spring/summer Chinook exhibit a "stream" type juvenile life history pattern, rearing for one, or sometimes even two years in freshwater before migrating to the ocean from April through June. These smolts are often referred to "yearling" Chinook. Adults typically remain in the ocean for two or three years before returning to spawn (Matthews and Waples 1991).

SR Sockeye Salmon

Before the turn of the century (c. 1880), about 150,000 sockeye salmon ascended the Wallowa, Payette, and Salmon River basins to spawn in natural lakes (Evermann 1896). Sockeye populations in the Payette basin lakes were eliminated after a diversion dam near Horseshoe Bend was constructed in 1914, and Black Canyon Dam was completed in 1924. In 1916, a dam at Wallowa Lake was increased in height, resulting in the extinction of indigenous sockeye in Wallowa Lake. Sockeye salmon in the Salmon River occurred historically in at least four lakes within Idaho's Stanley basin: Alturas, Redfish, Pettit, and Stanley Lakes. Sunbeam Dam, 20 miles downstream from Redfish Lake, severely limited sockeye and other anadromous salmonid production in the upper Salmon River between 1910 to 1934 (Waples *et al.* 1991a). In the 1950s and 1960s, more than 4,000 adults returned annually to Redfish Lake. Only 10 sockeye have returned to Redfish Lake since 1994: one in 1994, one in 1996, one in 1998 and seven in 1999 (all of those returning in 1999 were 2nd generation progeny of wild sockeye that returned to Idaho in 1993). Since 1991, adult sockeye returning to Redfish Lake have been captured to support a captive broodstock program.

Historically, SR sockeye salmon adults entered the Columbia River in June and July, migrated upstream through the Snake and Salmon Rivers, and arrived at Redfish Lake in August and September. Spawning peaks in October and occurs in lakeshore gravels. Fry emerge in late April and May and move immediately to the open waters of the lake where they feed on plankton for one to three years before migrating to the ocean. Juvenile sockeye generally leave Redfish Lake from late April through May, and migrate nearly 900 miles to the Pacific Ocean. Although pre-dam reports indicate that sockeye salmon smolts migrated in May and June, tagged sockeye smolts from Redfish Lake passed Lower Granite Dam from mid-May to mid-July. SR sockeye spend 2 to 3 years in the Pacific Ocean before returning to their natal lake to spawn.

<u>SR Steelhead</u>
Historically, SR steelhead spawned in virtually all accessible habitat in the Snake River up to Shoshone Falls (RM 615). The development of irrigation and hydropower projects on the mainstem Snake River have significantly reduced the amount of available habitat for this species (see discussion for spring/summer Chinook, above). No valid historical estimates of adult steelhead returning to the Snake River basin before the completion of Ice Harbor Dam in 1962 are available. However, SR steelhead sportfishing catches ranged from 20,000 to 55,000 fish during the 1960s (Fulton 1970). The run of steelhead was likely several times as large as the sportfish take. Between 1949 and 1971, adult steelhead counts at Lewiston Dam (on the Clearwater River) averaged about 40,000 per year. The count at Ice Harbor Dam in 1962 was 108,000, and averaged approximately 70,000 per year between 1963 and 1970.

A recent 5-year geometric mean (1990 to 1994) for escapement above Lower Granite Dam was approximately 71,000. However, the wild component of this run was only 9,400 adults (7,000 A-run and 2,400 B-run). In recent years average densities of wild juvenile steelhead have decreased significantly. Many basins within the Snake River are significantly under-seeded relative to the carrying capacity of streams (Busby *et al.* 1996).

Steelhead populations exhibit both anadromous (steelhead) and freshwater resident (rainbow or red-band trout) forms. Unlike other Pacific salmon species, steelhead are capable of spawning on more than one occasion, returning to the ocean to feed between spawning events. SR steelhead rarely return to spawn a second time. Steelhead can be classified into two reproductive types: (1) Stream-maturing steelhead, which enter fresh water in a sexually immature condition and wait several months before spawning; and (2) ocean-maturing steelhead, which return to freshwater with fully developed gonads and spawn shortly thereafter. In the Pacific Northwest, stream-maturing steelhead enter fresh water between May and October and are referred to as "summer" steelhead. In comparison, ocean-maturing steelhead return between November and April and are considered "winter" steelhead. Inland steelhead populations in the Columbia River basin are almost exclusively of the summer variety (Busby *et al.* 1996).

SR steelhead can be further divided into two groupings: A-run steelhead and B-run steelhead. This dichotomy reflects the bimodal migration of adult steelhead observed at Bonneville Dam. A-run steelhead generally return to fresh water between June and August after spending 1 year in the ocean. These fish are typically less than 77.5 centimeters (cm) in length. B-run steelhead usually return to fresh water from late August to October after spending 2 years in the ocean and are generally greater than 77.5 cm in length.

Both A-run and B-run spawn the following spring from March to May in small to mid-sized streams. The fry emerge in 7 to 10 weeks, depending on temperature, and usually spend 2 or 3 years in fresh water before migrating to the ocean from April to mid-June. These estimates are based on population averages and steelhead are capable of remarkable plasticity with in their life cycles.

Lower Columbia River (LCR) Chinook Salmon

The LCR Chinook salmon ESU includes all native populations from the mouth of the Columbia River to the crest of the Cascade Range, excluding populations above Willamette Falls. The former location of Celilo Falls (inundated by The Dalles reservoir in 1960) is the eastern boundary for this ESU. Stream-type, spring-run Chinook salmon found in the Klickitat River, or the introduced Carson spring-run Chinook salmon strain, are not included in this ESU. Spring-run Chinook salmon in the Sandy River have been influenced by spring-run Chinook salmon introduced from the Willamette River ESU. However, analyses suggest that considerable genetic resources still reside in the existing population (Myers *et al.* 1998). Recent escapements above Marmot Dam on the Sandy River average 2,800 and have been increasing (ODFW 1998).

Historical records of Chinook salmon abundance are sparse, but cannery records suggest a peak run of 4.6 million fish in 1883. Although fall-run Chinook salmon are still present throughout much of their historical range, most of the fish spawning today are first-generation hatchery strays. Furthermore, spring-run populations have been severely depleted throughout the ESU and extirpated from several rivers.

Apart from the relatively large and apparently healthy fall-run population in the Lewis River, production in this ESU appears to be predominantly hatchery-driven with few identifiable naturally-spawned populations. All basins are affected (to varying degrees) by habitat degradation. Hatchery programs have had a negative effect on the native ESU. Efforts to enhance Chinook salmon fisheries abundance in the lower Columbia River began in the 1870s. Available evidence indicates a pervasive influence of hatchery fish on natural populations throughout this ESU, including both spring- and fall-run populations. The large number of hatchery fish in this ESU make it difficult to determine the proportion of naturally-produced fish. The loss of fitness and diversity within the ESU is an important concern. The median population growth rate over a base period from 1980 through 1998 ranged from 0.98 to 0.88, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared with that of fish of wild origin (McClure *et al.* 2000).

Upper Columbia River (UCR) Spring Chinook Salmon

The UCR ESU includes spring-run Chinook populations found in Columbia River tributaries between Rock Island and Chief Joseph Dams, notably the Wenatchee, Entiat, and Methow River basins. The populations are genetically and ecologically separate from the summer- and fall-run populations in the lower parts of many of the same river systems (Myers *et al.* 1998). Although fish in this ESU are genetically similar to spring Chinook in adjacent ESUs, they are distinguished by ecological differences in spawning and rearing habitat preferences. For example, spring-run Chinook in upper Columbia River tributaries spawn at lower elevations (500 to 1,000 m) than in the Snake and John Day River systems.

The UCR populations were intermixed during the Grand Coulee Fish Maintenance Project (1939 through 1943), resulting in loss of genetic diversity between populations in the ESU. Homogenization remains an important feature of the ESU. Fish abundance has tended downward both recently and over the long term.

Given the lack of information on Chinook salmon stocks that are presumed to be extinct, the relationship of these stocks to existing ESUs is uncertain. Recent total abundance within this ESU is quite low, and escapements from 1994 to 1996 were the lowest in at least 60 years. At least six populations of spring Chinook salmon in this ESU have become extinct, and almost all remaining naturally-spawning populations have fewer than 100 spawners. Extinction risks for UCR spring Chinook salmon are 50% for the Methow, 98% for the Wenatchee, and 99% for the Entiat spawning populations (Cooney 2002). In 2002, the spring Chinook count at Priest Rapids Dam was 34,083, with 24,000 arriving at Rock Island Dam. The 2002 count was about 67.6% and 242% of the respective 2001 and 10-year average adult spring Chinook count at Priest Rapids Dam.

Upper Willamette River (UWR) Chinook Salmon

The UWR Chinook salmon ESU includes native spring-run populations above Willamette Falls and in the Clackamas River. In the past, it included sizable numbers of spawning salmon in the Santiam River, the middle fork of the Willamette River, and the McKenzie River, as well as smaller numbers in the Molalla River, Calapooia River, and Albiqua Creek. Although the total number of fish returning to the Willamette has been relatively high (24,000), about 4,000 fish now spawn naturally in the ESU, two-thirds of which originate in hatcheries. The McKenzie River supports the only remaining naturally-reproducing population in the ESU (ODFW 1998).

There are no direct estimates of the size of the Chinook salmon runs in the Willamette basin before the 1940s. The Native American fishery at the Willamette Falls may have yielded 908,000 kilograms of salmon (454,000 fish, each weighing 9.08 kilograms) (McKernan and Mattson 1950). Egg collections at salmon hatcheries indicate that the spring Chinook salmon run in the 1920s may have been five times the run size of 55,000 fish in 1947, or 275,000 fish (Mattson 1948). Much of the early information on salmon runs in the upper Willamette River basin comes from operation reports of state and Federal hatcheries.

Fish in this ESU are distinct from those of adjacent ESUs in life history and marine distribution. The life history of Chinook salmon in the UWR ESU includes traits from both ocean- and stream-type development strategies. Tag recoveries indicate that the fish travel to the marine waters off British Columbia and Alaska. More Willamette fish are, however, recovered in Alaskan waters than fish from the LCR ESU. UWR Chinook salmon mature in their fourth or fifth years. Historically, 5-year-old fish dominated the spawning migration runs, however, recently most fish have matured at age 4. The timing of the spawning migration is limited by Willamette Falls. High flows in the spring allow access to the upper Willamette basin, whereas low flows in the summer and autumn prevent later-migrating fish from ascending the falls. The low flows may serve as an isolating mechanism, separating this ESU from others nearby.

While the abundance of UWR spring Chinook salmon has been relatively stable over the long term and there is evidence of some natural production, at present natural production and harvest levels the natural population is not replacing itself. With natural production accounting for only one-third of the natural spawning escapement, natural spawners may not be capable of replacing themselves even in the absence of fisheries. The introduction of fall-run Chinook into the basin and the laddering of Willamette Falls have increased the potential for genetic introgression between wild spring- and hatchery fall-run Chinook. Habitat blockage and degradation are significant problems in this ESU.

The median population growth rate over a base period from 1980 through 1998 ranges from 1.01 to 0.63, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared with that of fish of wild origin (McClure *et al.* 2000).

<u>Columbia River (CR) Chum Salmon</u>
Chum salmon of the CR ESU spawn in tributaries and in mainstem areas below Bonneville Dam. Most fish spawn on the Washington side of the Columbia River (Johnson *et al.* 1997). Previously, chum salmon were reported in almost every river in the lower Columbia River Basin, but most runs disappeared by the 1950s (Rich 1942, Marr 1943, Fulton 1970). Currently, WDFW regularly monitors only a few natural populations in the basin, one in Grays River, two in small streams near Bonneville Dam, and the mainstem area next to one of the latter two streams. Recently, spawning has occurred in the mainstem Columbia River at two spots near Vancouver, Washington, and in Duncan Creek below the Bonneville Dam.

Historically, the CR chum salmon ESU supported a large commercial fishery in the first half of this century, landing more than 500,000 fish per year as recently as 1942. Commercial catches declined beginning in the mid-1950s and in later years rarely exceeded 2,000 per year. There are now no recreational or directed commercial fisheries for chum salmon in the Columbia River, although chum salmon are taken incidentally in the gill-net fisheries for coho and Chinook salmon, and some tributaries have a minor recreational harvest (WDF *et al.* 1993). Observations of chum salmon still occur in most of the 13 basins/areas that were identified in 1951 as hosting chum salmon, however, fewer than 10 fish are usually observed in these areas. In 1999, the WDFW located another Columbia River mainstem spawning area for chum salmon near the I-205 bridge (WDFW 2000).

Chum salmon enter the Columbia River from mid-October through early December and spawn from early November to late December. Recent genetic analysis of fish from Hardy and Hamilton Creeks and from the Grays River indicate that these fish are genetically distinct from other chum salmon populations in Washington. Genetic variability within and between populations in several geographic areas is similar, and populations in Washington show levels of genetic subdivision typical of those seen between summer- and fall-run populations in other areas, and are typical of populations within run types (Salo 1991, WDF *et al.* 1993, Phelps *et al.* 1994, Johnson *et al.* 1997).

The median population growth rate is 1.04 over a base period from 1980 through 1998 for the ESU as a whole (McClure *et al.* 2000). Because census data are peak counts (and because the precision of those counts decreases markedly during the spawning season as water levels and turbidity rise), NOAA Fisheries is unable to estimate the risk of absolute extinction for this ESU.

Middle Columbia River (MCR) Steelhead

The MCR ESU occupies the Columbia River basin from above the Wind River in Washington and the Hood River in Oregon and continues upstream to include the Yakima River in Washington. The region includes some of the driest areas of the Pacific Northwest, generally receiving less than 40 cm of precipitation annually (Jackson 1993). Summer steelhead are widespread throughout the ESU; winter steelhead occur in Mosier, Chenowith, Mill, and Fifteenmile Creeks, Oregon, and in the Klickitat and White Salmon Rivers, Washington. The John Day River probably represents the largest native, naturally-spawning stock of steelhead in the region.

Estimates of historical (pre-1960s) abundance specific to this ESU are available for the Yakima River, which has an estimated run size of 100,000 (WDF *et al.* 1993). Assuming comparable run sizes for other drainage areas in this ESU, the total historical run size may have exceeded 300,000 steelhead (NOAA Fisheries 2000).

Life history information for this ESU has been summarized by NOAA Fisheries (2000). Most fish in this ESU smolt at two years and spend 1 to 2 years in salt water before reentering freshwater, where they may remain up to a year before spawning (Howell *et al.* 1985). All steelhead upstream of The Dalles Dam are summer-run (Schreck *et al.* 1986, Reisenbichler *et al.* 1992, Chapman *et al.* 1994, Busby *et al.* 1996). The Klickitat River, however, produces both summer and winter steelhead, and age-2-ocean steelhead dominate the summer steelhead, whereas most other rivers in the region produce about equal numbers of both age 1- and 2-ocean fish. A non-anadromous form co-occurs with the anadromous form in this ESU; information suggests that the two forms may not be isolated reproductively, except where barriers are involved.

Current population sizes are substantially lower than historic levels, especially in the rivers with the largest steelhead runs in the ESU, the John Day, Deschutes, and Yakima Rivers. At least two extinctions of native steelhead runs in the ESU have occurred (the Crooked and Metolius Rivers, both in the Deschutes River basin). For the MCR steelhead ESU as a whole, NOAA Fisheries (2000) estimates that the median population growth rate over the base period (1990 to 1998) ranges from 0.88 to 0.75, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared with that of fish of wild origin (McClure *et al.* 2000). In 2002, the count of Bonneville Dam steelhead totaled 481,036 and exceeded all counts recorded at Bonneville Dam since 1938, except the 2001 total, which was 633,464. Of the total return in 2002, 143,032 were considered wild steelhead (Fish Passage Center 2003).

LCR Steelhead

The LCR ESU encompasses all steelhead runs in tributaries between the Cowlitz and Wind Rivers on the Washington side of the Columbia, and the Willamette and Hood Rivers on the Oregon side. The populations of steelhead that make up the LCR steelhead ESU are distinguished from adjacent populations by genetic and habitat characteristics. The ESU consists of summer and winter coastal steelhead runs in the tributaries of the Columbia River as it cuts through the Cascades. These populations are genetically distinct from inland populations (east of the Cascades), as well as from steelhead populations in the Upper Willamette River basin and coastal runs north and south of the Columbia River mouth. Not included in the ESU are runs in the Willamette River above Willamette Falls (Upper Willamette River ESU), runs in the Little and Big White Salmon Rivers (Middle Columbia River ESU), and runs based on four imported hatchery stocks: (1) Early-spawning winter Chambers Creek/Lower Columbia River mix, (2) summer Skamania Hatchery stock, (3) winter Eagle Creek NFH stock, and (4) winter Clackamas River ODFW stock (63 FR 13351 and 13352). This area has at least 36 distinct runs (Busby *et al.* 1996), 20 of which were identified in the initial listing petition. In addition, numerous small tributaries have historical reports of fish, but no current abundance data. The major runs in the ESU, for which there are estimates of run size, are the Cowlitz River winter runs, Toutle River winter runs, Kalama River winter and summer runs, Lewis River winter and summer runs, Washougal River winter and summer runs, Wind River summer runs, Clackamas River winter and summer runs, Sandy River winter and summer runs, and Hood River winter and summer runs (NOAA Fisheries 2000).

All runs in the LCR steelhead ESU have declined from 1980 to 2000, with sharp declines beginning in 1995 (NOAA Fisheries 2000). Historic counts in some of the larger tributaries (Cowlitz, Kalama, and Sandy Rivers) probably exceeded 20,000 fish; more recent counts have been in the range of 1,000 to 2,000 fish (NOAA Fisheries 2000). Habitat loss, hatchery steelhead introgression, and harvest are the major contributors to the decline of steelhead in this ESU. For the LCR steelhead ESU, NOAA Fisheries (2000) estimates that the median population growth rate over the base period (1990 to 1998) ranges from 0.98 to 0.78, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared with that of fish of wild origin (McClure *et al.* 2000).

UWR Steelhead

The UWR steelhead ESU occupies the Willamette River and tributaries upstream of Willamette Falls, extending to and including the Calapooia River. These major river basins containing spawning and rearing habitat comprise more than 12,000 kilometers^2 in Oregon. Rivers that contain naturally-spawning winter-run steelhead include the Tualatin, Molalla, Santiam, Calapooia, Yamhill, Rickreall, Luckiamute, and Mary's, although the origin and distribution of steelhead in a number of these basins is being debated. Early migrating winter and summer steelhead have been introduced into the Upper Willamette River basin, but those components are not part of the ESU. Native winter steelhead within this ESU have been declining since 1971, and have exhibited large fluctuations in abundance.

Over the past several decades, total abundance of natural late-migrating winter steelhead ascending the Willamette Falls fish ladder has fluctuated several times over a range of approximately 5,000 to 20,000 spawners. However, the last peak occurred in 1988, and this peak has been followed by a steep and continuing decline. Abundance in each of year from 1993 to 1998, was below 4,300 fish, and the run in 1995 was the lowest in 30 years.

In general, native steelhead of the UWR are late-migrating winter steelhead, entering freshwater primarily in March and April. This atypical run timing appears to be an adaptation for ascending Willamette Falls, which functions as an isolating mechanism for UWR steelhead. Reproductive isolation resulting from the falls may explain the genetic distinction between steelhead from the Upper Willamette River basin and those in the lower river. UWR late-migrating steelhead are ocean-maturing fish. Most return at age 4, with a small proportion returning as 5-year-olds (Busby *et al.* 1996). Willamette Falls (Rkm 77) is a known migration barrier (NOAA Fisheries 2000). Winter steelhead and spring Chinook salmon historically occurred above the falls, whereas summer steelhead, fall Chinook, and coho salmon did not. Detroit and Big Cliff Dams cut off access to 540 km of spawning and rearing habitat in the North Santiam River. In general, habitat in this ESU has become substantially simplified since the 1800s by removal of large woody debris to increase the river's navigability.

Habitat loss, hatchery steelhead introgression, and harvest are the major contributors to the decline of steelhead in this ESU. For the UWR steelhead ESU, the estimated median population growth rate for 1990 to 1998 ranged from 0.94 to 0.87, decreasing as the effectiveness of hatchery fish spawning in the wild increased compared with that of fish of wild origin (McClure *et al.* 2000).

<u>UCR Steelhead</u>
This inland steelhead ESU occupies the Columbia River basin upstream from the Yakima River to the U.S./Canada border. Rivers in the area primarily drain the east slope of the northern Cascade Mountains and include the Wenatchee, Entiat, Methow, and Okanogan River basins.

Estimates of historical (pre-1960s) abundance specific to this ESU are available from fish counts at dams (NOAA Fisheries 2000). Counts at Rock Island Dam from 1933 to 1959 averaged 2,600 to 3,700, suggesting a pre-fishery run size exceeding 5,000 adults for tributaries above Rock Island Dam (Chapman *et al.* 1994, Busby *et al.* 1996). Lower Columbia River harvests had already depressed fish stocks during the period in which these counts were taken, thus, the pre-fishery estimate should be viewed with caution.

Habitat degradation, juvenile and adult mortality in the hydropower system, and unfavorable environmental conditions in both marine and freshwater habitats have contributed to the declines and represent risk factors for the future. Harvest in lower river fisheries and genetic homogenization from composite broodstock collection are other factors that may contribute significant risk to the UCR steelhead ESU.

The median population growth rate over a base period from 1990 through 1998 ranged from 0.94 to 0.66, decreasing as the effectiveness of hatchery fish spawning in the wild increased compared with that of fish of wild origin (Tables B-2a and B-2b in McClure *et al.* 2000). In 2002, 15,286 steelhead were counted at Rock Island Dam, compared with the 2001 count of 28,602, and the 10-year average return of 9,165. Of the total steelhead counted at Rock Island Dam in 2002, 10,353 were wild steelhead (Fish Passage Center 2003).

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